PATENT ABSTRACTS OF JAPAN

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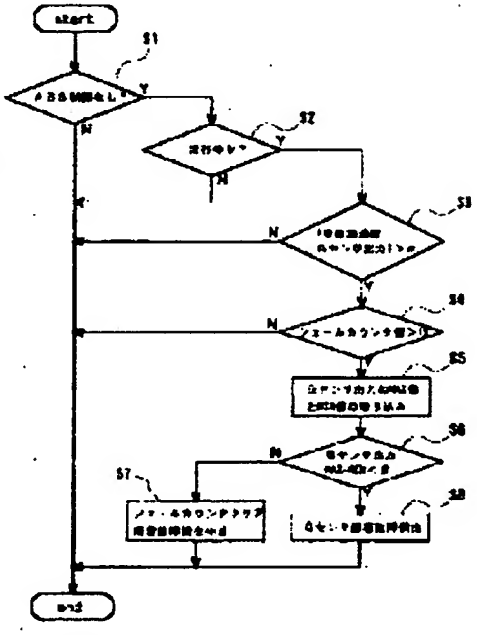
(54) METHOD AND DEVICE FOR OUTPUT FIXING FAILURE DETECTION OF VEHICULAR BODY ACCELERATION SENSOR

(57)Abstract:
PROBLEM TO BE SOLVED: To make it possible to precisely detect an output fixing failure even if the vehicle body acceleration speed is small, not mistakingly detecting the output fixing failure in spite of the normality of a vehicle body acceleration sensor when ascending and descending a big inclined sloping road or the like.
SOLUTION: When a vehicle is travelling at a speed faster than a constant speed (S2: Yes), not under ABS control (Step S1: Yes), a relative difference between a logical vehicle body acceleration speed to be computed from speed and a physical vehicle body acceleration speed to be output by a vehicle body acceleration sensor 1 is obtained, and is compared with a preset value α (S3). When the relative difference exceeds the preset value α (S3: Yes), then the count-up of a fail counter is started (S4). When the fail counter value to be obtained while the absolute value of the difference between the logical vehicle body acceleration speed and the physical vehicle body acceleration speed is over the preset value α exceeds one second (S4: Yes), the then difference between the maximum and minimum values of the physical vehicle body acceleration speed during the period and the preset value β are compared (S6), and when the difference is less than the preset value β (S6: Yes), the output from the sensor 1 is judged to be the output fixing failure as the output remains unchanged.



CLAIMS

[Claim(s)]

[Claim 1]Logical car body acceleration which is an output adherence failure detection method of a car-body-acceleration sensor carried in a car which has an anti-lock brake system for vehicles, and was calculated from wheel speed, A relative acceleration difference with physical car body acceleration which said car-body-acceleration sensor detected is calculated, Measure duration time in the state where this acceleration difference exceeded the default alpha, and while this acceleration difference is in a state beyond the default alpha, the minimum acceleration and maximum acceleration of said physical car body acceleration are memorized, When duration time in the state where said acceleration difference exceeded said default alpha exceeds between existing scheduled time, An output adherence failure detection method of a car-body-acceleration sensor characterized by what is judged as said car-body-acceleration sensor being an output adherence failed state when a difference of said memorized minimum acceleration and said maximum acceleration is below the default beta.

[Claim 2]Variation per unit time of logical car body acceleration which is an output adherence failure detection method of a car-body-acceleration sensor carried in a car which has an anti-lock brake system for vehicles, and was calculated from wheel speed, A relative variation difference with variation per unit time of physical car body acceleration which said car-body-acceleration sensor detected is calculated, Measure duration time in the state where this variation difference exceeded the default alpha, and while this variation difference is in a state beyond the default alpha, the maximum of variation per unit time of said physical car body acceleration is memorized, An output adherence failure detection method of a car-body-acceleration sensor characterized by what is judged as said car-body-acceleration sensor being an output adherence failed state when duration time in the state where said variation difference exceeded said default alpha exceeds between existing scheduled time and the maximum of said memorized variation is below the default beta.

[Claim 3]An output adherence failure detection method of a car-body-acceleration sensor characterized by what output adherence failure detection of said car-body-acceleration sensor is performed for in Claim 1 or 2 the time of anti-lock brake system un-controlling, and only while said car is running above a predetermined speed.

[Claim 4]An output adherence failure detection method of a car-body-acceleration sensor characterized by what a failure code is memorized for to a nonvolatile storage medium while making a fault lamp turn on and telling a driver about failure, when it judges with said car-body-acceleration sensor being an output adherence failed state in any 1 paragraph of Claims 1-3.

[Claim 5]A wheel speed sensor which is an output adherence fault detection device of a car-body-acceleration sensor carried in a car which has an anti-lock brake system for vehicles, and outputs an AC signal of frequency proportional to revolving speed of a wheel, A control section which has a calculation function which inputs an AC signal from a wheel speed sensor, calculates wheel speed, and computes car body acceleration logically from this wheel speed, Detect car body acceleration physically, have a car-body-acceleration sensor outputted to said control section, and said control section, A means to calculate a relative acceleration difference of logical car body acceleration calculated from said wheel speed, and physical car body acceleration which said car-body-acceleration sensor detected, A means to measure duration time in the state where this acceleration difference exceeded the default alpha, and a means to memorize the minimum

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acceleration and maximum acceleration of said physical car body acceleration while this acceleration difference is in a state beyond the default alpha, When duration time in the state where said acceleration difference exceeded said default alpha exceeds between existing scheduled time, An output adherence fault detection device of a car-body-acceleration sensor characterized by what it has a means to judge with said car-body-acceleration sensor being an output adherence failed state for when a difference of said memorized minimum acceleration and said maximum acceleration is below the default beta.

[Claim 6]An output adherence fault detection device of a car-body-acceleration sensor carried in a car which has an anti-lock brake system for vehicles characterized by comprising the following.

A wheel speed sensor which outputs an AC signal of frequency proportional to revolving speed of a wheel.

A control section which has a calculation function which inputs an AC signal from a wheel speed sensor, calculates wheel speed, and computes car body acceleration logically from this wheel speed.

Variation per unit time of logical car body acceleration which detected car body acceleration physically, was provided with a car-body-acceleration sensor outputted to said control section, and calculated said control section from said wheel speed.

A means to calculate a relative variation difference with variation per unit time of physical car body acceleration which said car-body-acceleration sensor detected, A means to measure duration time in the state where this variation difference exceeded the default alpha, and a means to memorize the maximum of variation per unit time of said physical car body acceleration while being in a state in which this variation difference exceeded the default alpha, A means to judge with said car-body-acceleration sensor being an output adherence failed state when duration time in the state where said variation difference exceeded said default alpha exceeds between existing scheduled time and the maximum of said memorized variation is below the default beta.

[Claim 7]An output adherence fault detection device of a car-body-acceleration sensor characterized by what said control section has a means to perform output adherence failure detection of said car-body-acceleration sensor the time of anti-lock brake system un-controlling, and only while said car is running above a predetermined speed for in Claim 5 or 6.

[Claim 8]Any 1 paragraph of Claims 5-7 characterized by comprising the following.

A means to make a fault lamp for said control section to tell a driver about failure when said car-body-acceleration sensor judges with it being an output adherence failed state turn on.

A means to memorize a failure code to a nonvolatile storage medium.

[Claim 9]An output adherence fault detection device of a car-body-acceleration sensor characterized by what said car-body-acceleration sensor is an analog type G sensor in any 1 paragraph of Claims 5-8.

[Claim 10]An anti-lock brake system for vehicles which equipped any 1 paragraph of Claims 5-9 with an output adherence fault detection device of a car-body-acceleration sensor of a description.

[Claim 11]Output adherence failure detection programs of a car-body-acceleration sensor characterized by comprising the following which make a computer perform output adherence failure detection of a car-body-acceleration sensor carried in a car which has an anti-lock brake system for vehicles.

Logical car body acceleration calculated from wheel speed.

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A procedure of calculating a relative acceleration difference with physical car body acceleration which said car-body-acceleration sensor detected.
A procedure which measures duration time in the state where this acceleration difference exceeded the default alpha.
When a procedure of memorizing the minimum acceleration and maximum acceleration of said physical car body acceleration, and duration time in the state where said acceleration difference exceeded said default alpha exceed between existing scheduled time while this acceleration difference was in a state beyond the default alpha, A procedure judged as said car-body-acceleration sensor being an output adherence failed state when a difference of said memorized minimum acceleration and said maximum acceleration is below the default beta.

[Claim 12]They are output adherence failure detection programs of a car-body-acceleration sensor which make a computer perform output adherence failure detection of a car-body-acceleration sensor carried in a car which has an anti-lock brake system for vehicles, Variation per unit time of logical car body acceleration calculated from said wheel speed, A procedure of calculating a relative variation difference with variation per unit time of physical car body acceleration which said car-body-acceleration sensor detected, A procedure which measures duration time in the state where this variation difference exceeded the default alpha, and a procedure of memorizing the maximum of variation per unit time of said physical car body acceleration while being in a state in which this variation difference exceeded the default alpha, When duration time in the state where said variation difference exceeded said default alpha exceeds between existing scheduled time, Output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has for a procedure judged as said car-body-acceleration sensor being an output adherence failed state when the maximum of said memorized variation is below the default beta.
[Claim 13]Output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has the procedure of performing output adherence failure detection of said car-body-acceleration sensor in Claim 11 or 12 the time of anti-lock brake system un-controlling, and only while said car is running above a predetermined speed for.
[Claim 14]A procedure of making a fault lamp for telling a driver about failure turning on when it judges with said car-body-acceleration sensor being an output adherence failed state in any 1 paragraph of Claims 11-13, Output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has the procedure of memorizing a failure code to a nonvolatile storage medium for.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]The invention in this application relates to the output adherence failure detection programs of the output adherence failure detection method of the car-body-acceleration sensor carried in the car which has an anti-lock brake system for vehicles, the output adherence fault detection device of a car-body-acceleration sensor, and a car-body-acceleration sensor.

[0002]

[Description of the Prior Art]A wheel decelerating signal required for control of an anti-lock brake system (hereafter referred to as ABS) can be easily obtained by two-wheel-drive car with a non driving wheel. However, since all the wheels are connected with the large engine of moment of inertia when a center differential and a rear wheel shaft differential are locked and four wheels set in the direct connection state in a four-wheelp-drive car, The speed of response of the wheel to change of braking torque falls remarkably. For this reason, it will almost be impossible to acquire a wheel decelerating signal, and a wheel will be locked by it.

[0003]Generally as one of the means for solving such a problem, the car-body-acceleration sensor is carried in the four-wheelp-drive car. By this car-body-acceleration sensor, the car body acceleration of the direction of movement of the body is measured, and if the deceleration at the time of brake braking is smaller than constant value, it will judge with it being a road surface with the low frictional resistance value mu (henceforth a low mu road side). and a road surface with the high frictional resistance value mu (henceforth a high mu road surface) -- the lock of the wheel is prevented by switching to the slip control logic for low mu road sides from the slip control logic of business, and raising control precision.

[0004]Therefore, this car-body-acceleration sensor is indispensable in ABS of a four-wheelp-drive car. When a car-body-acceleration sensor breaks down, slip control becomes impossible and a possibility that a wheel may lock arises.

Therefore, it can be said that the failure detection of a car-body-acceleration sensor is indispensable. The failure mode of a car-body-acceleration sensor has the output adherence failure from which the acceleration of the body will be followed, outputting a fixed car-body-acceleration signal as one of them, and a car-body-acceleration output signal will not change, although some failure modes are assumed.

[0005]

[Problem(s) to be Solved by the Invention]As the 1st conventional technology that detects output adherence failure of this car-body-acceleration sensor, the art currently indicated by JP,H1-195168,A is publicly known. At the time of ABS un-controlling, this measures the car body acceleration calculated from the output of the wheel speed sensor, and the car body acceleration which the car-body-acceleration sensor detected, and when the difference is beyond a predetermined value, it judges with a car-body-acceleration sensor being output adherence failure.

[0006]However, although a car-body-acceleration sensor is normal when going up the slope which has a big angle of inclination, for example or going down, a big difference may arise between the car body acceleration calculated from the output of the wheel speed sensor, and the car body acceleration which the car-body-acceleration sensor detected. Therefore, there is a possibility that it may detect output adherence failure

accidentally.

[0007]The art currently indicated by JP,H8-184610,A is publicly known as the 2nd conventional technology that canceled the fault of the 1st conventional technology shown above. This sets as a threshold the car body acceleration which acts on the body with the gravity assumed when going up the slope which has a sufficiently big angle of inclination or going down, When the car body acceleration calculated from the output of the wheel speed sensor is larger than this threshold and the car body acceleration which the car-body-acceleration sensor detected is smaller than this threshold, it judges with a car-body-acceleration sensor being output adherence failure. It is defined as other conditions at the time of judging with output adherence failure that it is at the ABS time of not controlling, that the body is running, and that the wheel speed difference of two or more wheels is below the predetermined speed difference.

[0008]Thus, by setting the car body acceleration which acts on the body with the gravity at the time of the 2nd conventional technology shown above going up the slope which has a sufficiently big angle of inclination, or going down as a threshold, When going up the slope which has a big angle of inclination or going down, although a car-body-acceleration sensor is normal, it prevents detecting output adherence failure accidentally.

[0009]However, unless the car body acceleration equivalent to it acts on the body when the 2nd conventional technology shown above goes up the slope which has a sufficiently big angle of inclination or it goes down or, output adherence failure of a car-body-acceleration sensor can be detected. Therefore, for example, since the car body acceleration which acts on the body is small at the time of a flat low mu road side run, even if output adherence failure of a car-body-acceleration sensor occurs, it cannot detect, but there is a possibility that ABS for vehicles may not operate normally by it.

[0010]In view of such a situation, accomplish the invention in this application, and the SUBJECT, Without detecting output adherence failure accidentally, although a car-body-acceleration sensor is normal when going up the slope which has a big angle of inclination or going down, And it is that the car body acceleration which acts on the body enables detection of output adherence failure of a car-body-acceleration sensor exactly also in a small situation.

[0011]

[Means for Solving the Problem]In order to attain an aforementioned problem, an invention of a description to claim in this application 1, Logical car body acceleration which is an output adherence failure detection method of a car-body-acceleration sensor carried in a car which has ABS for vehicles, and was calculated from wheel speed, A relative acceleration difference with physical car body acceleration which said car-body-acceleration sensor detected is calculated, Measure duration time in the state where this acceleration difference exceeded the default alpha, and while this acceleration difference is in a state beyond the default alpha, the minimum acceleration and maximum acceleration of said physical car body acceleration are memorized, When duration time in the state where said acceleration difference exceeded said default alpha exceeds between existing scheduled time, When a difference of said memorized minimum acceleration and said maximum acceleration is below the default beta, it is an output adherence failure detection method of a car-body-acceleration sensor characterized by what is judged as said car-body-acceleration sensor being an output adherence failed state.

[0012]First, since a relative acceleration difference of logical car body acceleration calculated from wheel

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speed and physical car body acceleration which a car-body-acceleration sensor detected is compared, even if car body acceleration which acts on the body is small, it becomes possible to detect output adherence failure of a car-body-acceleration sensor. And when duration time in the state where the acceleration difference exceeded the default alpha is measured and the duration time exceeds between existing scheduled time, Since it judges with a car-body-acceleration sensor being an output adherence failed state, there are few possibilities of detecting output adherence failure accidentally with a level difference of a road surface, etc. even if momentarily strong car body acceleration acts on the body.

[0013]Here, as long as a car-body-acceleration sensor is functioning normally, the default alpha is set as the maximum of a relative acceleration difference of a logical car-body-acceleration curve and a physical car-body-acceleration curve which may be produced continuously, and is calculated by experiment etc. In a range without fear of erroneous detection of output adherence failure, the smaller possible one of this default alpha is preferred, and detection of output adherence failure is attained by high sensitivity. As long as a car-body-acceleration sensor is functioning normally, it is set as time when a relative acceleration difference of a logical car-body-acceleration curve and a physical car-body-acceleration curve is longer than time continuously exceeding the default alpha during existing scheduled time, and it is called for by experiment etc. In a range without fear of erroneous detection of output adherence failure, the shorter possible one is preferred during this existing scheduled time, and detection of output adherence failure is attained in shorter time.

[0014]While said acceleration difference is in a state beyond the default alpha, the minimum acceleration and maximum acceleration of physical car body acceleration are memorized. And when duration time in the state where said acceleration difference exceeded the default alpha exceeds between existing scheduled time, only when a difference of the minimum acceleration of car body acceleration and maximum acceleration which were memorized is below the default beta, it judges with a car-body-acceleration sensor being an output adherence failed state. The default beta is set as the maximum of the acceleration range of fluctuation which a car-body-acceleration sensor outputs in the state where a car-body-acceleration sensor is carrying out output adherence failure, and is calculated by experiment etc. here. In a range without fear of erroneous detection of output adherence failure, the smaller possible one of this default beta is preferred, and detection of output adherence failure is attained in high accuracy.

[0015]When said acceleration difference continues during existing scheduled time, and exceeds the default alpha by this, and said the acceleration difference goes up a slope which has a big angle of inclination or it goes down, it can be judged whether it produces by change of car body acceleration which acts on the body with gravity. That is, if a car-body-acceleration sensor is carrying out output adherence failure, car body acceleration which a car-body-acceleration sensor outputs should not be changed, When a car-body-acceleration sensor goes up a slope which has a big angle of inclination in the normal state or it goes down, car body acceleration which a car-body-acceleration sensor outputs can be judged by changing sharply.

[0016]According to the output adherence failure detection method of a car-body-acceleration sensor concerning an invention given in claim in this application 1, by this. Without detecting output adherence failure accidentally, although a car-body-acceleration sensor is normal when going up a slope which has a big angle of inclination or going down, And a operation effect of becoming possible to detect output adherence failure of a car-body-acceleration sensor exactly also in a situation where car body acceleration which acts on the body is small is obtained.

[0017]Variation per unit time of logical car body acceleration which an invention given in claim in this application 2 is an output adherence failure detection method of a car-body-acceleration sensor carried in a car which has ABS for vehicles, and was calculated from wheel speed, A relative variation difference with variation per unit time of physical car body acceleration which said car-body-acceleration sensor detected is calculated, Measure duration time in the state where this variation difference exceeded the default alpha, and while this variation difference is in a state beyond the default alpha, the maximum of variation per unit time of said physical car body acceleration is memorized, When duration time in the state where said variation difference exceeded said default alpha exceeds between existing scheduled time and the maximum of said memorized variation is below the default beta, it is an output adherence failure detection method of a car-body-acceleration sensor characterized by what is judged as said car-body-acceleration sensor being an output adherence failed state.

[0018]Thus, since a relative variation difference of variation per unit time of logical car body acceleration calculated from wheel speed and variation per unit time of physical car body acceleration which a car-body-acceleration sensor detected is compared, Even if car body acceleration which acts on the body is small, it becomes possible to detect output adherence failure of a car-body-acceleration sensor. And when duration time in the state where said variation difference exceeded the default alpha is measured and the duration time exceeds between existing scheduled time, Since it judges with a car-body-acceleration sensor being an output adherence failed state, there are few possibilities of detecting output adherence failure accidentally with a level difference of a road surface, etc. even if it changes variation per unit time of car body acceleration momentarily.

[0019]Here, as long as a car-body-acceleration sensor is functioning normally, the default alpha is set as a bigger value than the maximum of said variation difference which may be produced continuously, and is calculated by experiment etc. In a range without fear of erroneous detection of output adherence failure, the smaller possible one of this default alpha is preferred, and detection of output adherence failure is attained by high sensitivity. As long as a car-body-acceleration sensor is functioning normally, it is set as time when said variation difference is longer than time continuously exceeding the default alpha during existing scheduled time, and it is called for by experiment etc. In a range without fear of erroneous detection of output adherence failure, the shorter possible one is preferred during this existing scheduled time, and detection of output adherence failure is attained in shorter time.

[0020]While said variation difference is in a state beyond the default alpha, the maximum of variation per unit time of physical car body acceleration is memorized. And when duration time in the state where said variation difference exceeded the default alpha exceeds between existing scheduled time, only when the maximum of variation per unit time of memorized car body acceleration is below the default beta, it judges with a car-body-acceleration sensor being an output adherence failed state. The default beta is set as the maximum of the acceleration range of fluctuation in which a car-body-acceleration sensor carries out a car-body-acceleration sensor output in the state where output adherence failure is carried out, and is calculated by experiment etc. here. In a range without fear of erroneous detection of output adherence failure, the smaller possible one of this default beta is preferred, and detection of output adherence failure is attained in high accuracy.

[0021]When said variation difference continues during existing scheduled time, and exceeds the default alpha by this, and said the variation difference goes up a slope which has a big angle of inclination or it goes down,

it can be judged whether it is what is depended on change of car body acceleration which acts on the body with gravity. That is, if a car-body-acceleration sensor is carrying out output adherence failure, car body acceleration which a car-body-acceleration sensor outputs should not be changed, When a car-body-acceleration sensor goes up a slope which has a big angle of inclination in the normal state or it goes down, car body acceleration which a car-body-acceleration sensor outputs can be judged by changing sharply.

[0022]Since a relative variation difference of variation per unit time of logical car body acceleration calculated from wheel speed and variation per unit time of physical car body acceleration which a car-body-acceleration sensor detected is compared, Since influence of a gap of a relative acceleration difference of logical car body acceleration and physical car body acceleration is not received, detection of output adherence failure of a car-body-acceleration sensor is attained in still higher accuracy rather than comparing a relative acceleration difference of car body acceleration.

[0023]According to the output adherence failure detection method of a car-body-acceleration sensor concerning an invention given in claim in this application 2, by this. When going up a slope which has a big angle of inclination to claim in this application 1 like an invention of a description or going down, A operation effect of becoming possible to detect output adherence failure of a car-body-acceleration sensor exactly also in a situation where car body acceleration which acts on the body is small is obtained without detecting output adherence failure accidentally, although a car-body-acceleration sensor is normal. Since influence of a gap of a relative acceleration difference of logical car body acceleration and physical car body acceleration is not received in addition to the above-mentioned operation effect, detection of output adherence failure of a car-body-acceleration sensor is attained in still higher accuracy rather than comparing a relative acceleration difference of car body acceleration.

[0024]An invention given in claim in this application 3 is an output adherence failure detection method of a car-body-acceleration sensor characterized by what output adherence failure detection of said car-body-acceleration sensor is performed for the time of ABS un-controlling, and only while said car is running above a predetermined speed in Claim 1 or 2.

[0025]Since a big difference may arise between body speed and wheel speed at the time of ABS control, a possibility that it may detect output adherence failure of a car-body-acceleration sensor accidentally arises. Therefore, it becomes possible by performing output adherence failure detection of a car-body-acceleration sensor at the time of ABS un-controlling to lessen a possibility of detecting output adherence failure of a car-body-acceleration sensor accidentally.

[0026]Although wheel speed under stop is 0 and car body acceleration is also 0, an output of a car-body-acceleration sensor may be changed by factors, such as people's getting on and off, taking up and down of a cargo, or a stop at a slope. Therefore, a possibility that it may detect output adherence failure of a car-body-acceleration sensor accidentally arises. Therefore, when it is not [jam / which is under run above a predetermined speed] under stop, it becomes possible by performing output adherence failure detection of a car-body-acceleration sensor to lessen a possibility of detecting output adherence failure of a car-body-acceleration sensor accidentally.

[0027]According to the output adherence failure detection method of a car-body-acceleration sensor concerning an invention given in claim in this application 3, by this. 2 to claim in this application 1 or a operation effect by invention of a description in addition, by performing output adherence failure detection of a

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car-body-acceleration sensor, the time of ABS un-controlling, and only while a car is running above a predetermined speed, A operation effect of becoming possible to lessen a possibility of detecting output adherence failure of a car-body-acceleration sensor accidentally is obtained.

[0028]When it judges with said car-body-acceleration sensor being an output adherence failed state in any 1 paragraph of Claims 1-3, an invention given in claim in this application 4, While making a fault lamp turn on and telling a driver about failure, it is an output adherence failure detection method of a car-body-acceleration sensor characterized by what a failure code is memorized for to a nonvolatile storage medium.

[0029]Thus, when [whose a car-body-acceleration sensor is output adherence failure] it judges, Since it tells that made a fault lamp provided in in the car turn on, a certain failure occurred in ABS to a driver, and an ABS control function has stopped, it enables him for a driver to recognize it and to take suitable action. Simultaneously, since a failure code is memorized to a nonvolatile storage medium, it becomes possible by referring to a failure code to get to know that a factor which a fault lamp turned on is output adherence failure of a car-body-acceleration sensor.

[0030]According to the output adherence failure detection method of a car-body-acceleration sensor concerning an invention given in claim in this application 4, by this. While being able to urge a driver's suitable action by transmitting failure of ABS to a driver at the time of output adherence failure of a car-body-acceleration sensor in addition to a operation effect by invention given in any 1 paragraph of claim in this application 1-3, Flume ********** which can recognize that trouble indication of ABS is output adherence failure of a car-body-acceleration sensor is obtained.

[0031]A wheel speed sensor which an invention given in claim in this application 5 is an output adherence fault detection device of a car-body-acceleration sensor carried in a car which has ABS for vehicles, and outputs an AC signal of frequency proportional to revolving speed of a wheel, A control section which has a calculation function which inputs an AC signal from a wheel speed sensor, calculates wheel speed, and computes car body acceleration logically from this wheel speed, Detect car body acceleration physically, have a car-body-acceleration sensor outputted to said control section, and said control section, A means to calculate a relative acceleration difference of logical car body acceleration calculated from said wheel speed, and physical car body acceleration which said car-body-acceleration sensor detected, A means to measure duration time in the state where this acceleration difference exceeded the default alpha, and a means to memorize the minimum acceleration and maximum acceleration of said physical car body acceleration while this acceleration difference is in a state beyond the default alpha, When duration time in the state where said acceleration difference exceeded said default alpha exceeds between existing scheduled time, When a difference of said memorized minimum acceleration and said maximum acceleration is below the default beta, it is an output adherence fault detection device of a car-body-acceleration sensor characterized by what it has a means to judge with said car-body-acceleration sensor being an output adherence failed state for. According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 5, the same operation effect as an invention of a description can be obtained to claim in this application 1 mentioned above.

[0032]A wheel speed sensor which an invention given in claim in this application 6 is an output adherence fault detection device of a car-body-acceleration sensor carried in a car which has ABS for vehicles, and outputs an AC signal of frequency proportional to revolving speed of a wheel, A control section which has a

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calculation function which inputs an AC signal from a wheel speed sensor, calculates wheel speed, and computes car body acceleration logically from this wheel speed, Detect car body acceleration physically, have a car-body-acceleration sensor outputted to said control section, and said control section, Variation per unit time of logical car body acceleration calculated from said wheel speed, A means to calculate a relative variation difference with variation per unit time of physical car body acceleration which said car-body-acceleration sensor detected, A means to measure duration time in the state where this variation difference exceeded the default alpha, and a means to memorize the maximum of variation per unit time of said physical car body acceleration while being in a state in which this variation difference exceeded the default alpha, When duration time in the state where said variation difference exceeded said default alpha exceeds between existing scheduled time, When the maximum of said memorized variation is below the default beta, it is an output adherence fault detection device of a car-body-acceleration sensor characterized by what it has a means to judge with said car-body-acceleration sensor being an output adherence failed state for. According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 6, the same operation effect as an invention of a description can be obtained to claim in this application 2 mentioned above.

[0033]In Claim 5 or 6, an invention of a description to claim in this application 7 said control section, The time of ABS un-controlling, and only while said car is running above a predetermined speed, it is an output adherence fault detection device of a car-body-acceleration sensor characterized by what it has a means to perform output adherence failure detection of said car-body-acceleration sensor for. According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 7, the same operation effect as an invention of a description can be obtained to claim in this application 3 mentioned above.

[0034]In any 1 paragraph of Claims 5-7, an invention of a description to claim in this application 8 said control section, When it judges with said car-body-acceleration sensor being an output adherence failed state, it is an output adherence fault detection device of a car-body-acceleration sensor characterized by what it has a means to make a fault lamp for telling a driver about failure turn on, and a means to memorize a failure code to a nonvolatile storage medium for. According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 8, the same operation effect as an invention of a description can be obtained to claim in this application 4 mentioned above.

[0035]An invention given in claim in this application 9 is an output adherence fault detection device of a car-body-acceleration sensor characterized by what said car-body-acceleration sensor is an analog type G sensor in any 1 paragraph of Claims 5-8.

[0036]An analog type G sensor comprises an electronic circuit using a Hall device, detects acceleration of a cross direction which acts on the body at a fine step, and an output is possible for it. Since it comprises an electronic circuit, when one of the electronic devices breaks and an output of a car-body-acceleration signal adheres, for example by a certain factor, there is no telling with which value a value of car body acceleration adheres. An output signal which adhered may be changed to some extent.

[0037]According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 9. It becomes possible to detect output adherence failure in high accuracy by a operation effect by invention of a description in a car-body-acceleration sensor using an analog

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type G sensor mentioned above in any 1 paragraph of claim in this application 5-8.

[0038]An invention given in claim in this application 10 is ABS for vehicles which equipped any 1 paragraph of Claims 5-9 with an output adherence fault detection device of a car-body-acceleration sensor of a description. According to ABS for vehicles concerning an invention given in claim in this application 10, in ABS for vehicles, a operation effect by invention given in any 1 paragraph of claim in this application 5-9 mentioned above can be obtained.

[0039]Inventions given in claim in this application 11 are output adherence failure detection programs of a car-body-acceleration sensor which make a computer perform output adherence failure detection of a car-body-acceleration sensor carried in a car which has ABS for vehicles, A procedure of calculating a relative acceleration difference of logical car body acceleration calculated from wheel speed, and physical car body acceleration which said car-body-acceleration sensor detected, A procedure which measures duration time in the state where this acceleration difference exceeded the default alpha, and a procedure of memorizing the minimum acceleration and maximum acceleration of said physical car body acceleration while this acceleration difference is in a state beyond the default alpha, When duration time in the state where said acceleration difference exceeded said default alpha exceeds between existing scheduled time, When a difference of said memorized minimum acceleration and said maximum acceleration is below the default beta, they are output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has for a procedure judged as said car-body-acceleration sensor being an output adherence failed state.

[0040]While being able to obtain the same operation effect as an invention of a description to claim in this application 1 mentioned above according to the output adherence failure detection programs of a car-body-acceleration sensor concerning an invention given in claim in this application 11, The same operation effect as an invention of a description can be brought to claim in this application 1 mentioned above in arbitrary cars which have ABS for vehicles which can execute output adherence failure detection programs of this car-body-acceleration sensor.

[0041]Inventions given in claim in this application 12 are output adherence failure detection programs of a car-body-acceleration sensor which make a computer perform output adherence failure detection of a car-body-acceleration sensor carried in a car which has ABS for vehicles, Variation per unit time of logical car body acceleration calculated from said wheel speed, A procedure of calculating a relative variation difference with variation per unit time of physical car body acceleration which said car-body-acceleration sensor detected, A procedure which measures duration time in the state where this variation difference exceeded the default alpha, and a procedure of memorizing the maximum of variation per unit time of said physical car body acceleration while being in a state in which this variation difference exceeded the default alpha, When duration time in the state where said variation difference exceeded said default alpha exceeds between existing scheduled time, When the maximum of said memorized variation is below the default beta, they are output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has for a procedure judged as said car-body-acceleration sensor being an output adherence failed state.

[0042]While being able to obtain the same operation effect as an invention of a description to claim in this application 2 mentioned above according to the output adherence failure detection programs of a car-body-acceleration sensor concerning an invention given in claim in this application 12, The same operation effect

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as an invention of a description can be brought to claim in this application 2 mentioned above in arbitrary cars which have ABS for vehicles which can execute output adherence failure detection programs of this car-body-acceleration sensor.

[0043]In Claim 11 or 12, an invention of a description to claim in this application 13 At the time of ABS un-controlling. And only while said car is running above a predetermined speed, they are output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has the procedure of performing output adherence failure detection of said car-body-acceleration sensor for.

[0044]While being able to obtain the same operation effect as an invention of a description to claim in this application 3 mentioned above according to the output adherence failure detection programs of a car-body-acceleration sensor concerning an invention given in claim in this application 13, The same operation effect as an invention of a description can be brought to claim in this application 3 mentioned above in arbitrary cars which have ABS for vehicles which can execute output adherence failure detection programs of this car-body-acceleration sensor.

[0045]In any 1 paragraph of Claims 11-13 an invention of a description to claim in this application 14, When it judges with said car-body-acceleration sensor being an output adherence failed state, they are output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has a procedure of making a fault lamp for telling a driver about failure turning on, and the procedure of memorizing a failure code to a nonvolatile storage medium for.

[0046]While being able to obtain the same operation effect as an invention of a description to claim in this application 4 mentioned above according to the output adherence failure detection programs of a car-body-acceleration sensor concerning an invention given in claim in this application 14, The same operation effect as an invention of a description can be brought to claim in this application 4 mentioned above in arbitrary cars which have ABS for vehicles which can execute output adherence failure detection programs of this car-body-acceleration sensor.

[0047]

[Embodiment of the Invention]Hereafter, the 1 embodiment of the invention in this application is described based on Drawings. Drawing 1 is a block diagram of an outline showing the system configuration of ABS for vehicles concerning the invention in this application provided with the car-body-acceleration sensor.

[0048]The basic constitution of ABS for vehicles comprises the wheel speed sensor 4, ECU(electronic control unit) 2 as a "control section" concerning the invention in this application, and the fluid pressure unit 3.

[0049]The wheel speed sensor 4 generates the AC signal of the frequency proportional to the revolving speed of the wheel 41 by detecting the cog in the wheel 42 rotated with the wheel 41.

[0050]ECU2 inputted the AC signal transmitted from the wheel speed sensor 4, it calculated wheel speed, and is provided with the arithmetic block 21 which has a calculation function which computes slip ratio and the degree of wheel acceleration and deceleration based on it. ECU2 inputted the slip ratio and the degree of wheel acceleration and deceleration which the arithmetic block 21 computed, was combined logically, generated the control instruction to brake pressure, and is provided with the control block 22 which has a control facility transmitted to the fluid pressure unit 3. When ECU2 performs the function check and surveillance of each component parts or the whole system and a defect arises in them, After carrying out an alarm to a driver with the alarm lamp 5, the warning buzzer which is not illustrated, etc., while stopping an

ABS control function, it has the monitor block 23 which has a system-monitor function which usually enables operation of a brake.

[0051]The fluid pressure unit 3 is allocated between the master cylinder 6 and the wheel cylinder 44, The brake pedal 7 steps on and brake pressure is made to fluctuate directly or indirectly in response to the control instruction from ECU2 by driving the electromagnetic valve 31, a pump, a motor which are not illustrated, etc. apart from the change in brake pressure to the brake disc 43 by power.

[0052]The car-body-acceleration sensor 1 is a sensor which detects the acceleration of a direction of movement. And it judges with being a low mu road side, if the car body acceleration which the car-body-acceleration sensor 1 outputs has the deceleration smaller than constant value which it was inputted into the arithmetic block 21 of ECU2, and the car-body-acceleration sensor 1 detected. And the control block 22 has prevented the lock of the wheel 41 by switching to the slip control logic for low mu road sides from the slip control logic for high mu road surfaces, and raising control precision. The failure surveillance of the car-body-acceleration sensor 1 is carried out at the monitor block 23. In the embodiment concerned, the car-body-acceleration sensor 1 is an analog type G sensor. The analog type G sensor comprises an electronic circuit using a Hall device, detects the acceleration of the cross direction which acts on the body at a fine step, and an output is possible for it. Even if the car-body-acceleration sensor 1 in particular is not limited to an analog type G sensor and is the car-body-acceleration sensor 1 by other methods, operation of the invention in this application is possible for it.

[0053]The output adherence failure detection procedure of the car-body-acceleration sensor 1 concerning the invention in this application in ABS which accomplishes such basic constitution is explained hereafter, referring to a timing chart and a flow chart.

[0054]Drawing 2 is the timing chart which showed the timing of the output adherence failure detection of the car-body-acceleration sensor concerning the invention in this application. The curve shown with the numerals A is a logical car-body-acceleration curve which showed the logical car body acceleration calculated from wheel speed. The curve shown with the numerals B is a physical car-body-acceleration curve which showed the physical car body acceleration detected by the car-body-acceleration sensor 1. The curve of the dashed line shown by Amax is a car-body-acceleration curve which added the default alpha to the logical car-body-acceleration curve as a graphic display, and the curve of the dashed line shown by Amin is a car-body-acceleration curve which subtracted the default alpha from the logical car-body-acceleration curve as a graphic display.

[0055]Here, the default alpha is a value which is set as the maximum of the relative acceleration difference of the logical car-body-acceleration curve and physical car-body-acceleration curve which may be produced continuously, and is calculated by experiment etc., as long as the car-body-acceleration sensor 1 is functioning normally as mentioned above. In the range without fear of the erroneous detection of output adherence failure, the smaller possible one of this default alpha is preferred, and detection of output adherence failure is attained by high sensitivity. Therefore, a physical car-body-acceleration curve does not perform output adherence failure detection of a car-body-acceleration sensor, while changing the field between the car-body-acceleration curve of Amax, and the car-body-acceleration curve of Amin. In the embodiment concerned, the default alpha is set as about 1.47 m/S^2. Although not illustrated, the curve of the above-mentioned car body acceleration is a curve which made the vertical axis car body acceleration and to

which it set the time-axis as the horizontal axis.

[0056]A fail counter counts the duration time [the physical car-body-acceleration curve is changing the outside of the field between the car-body-acceleration curve of Amax, and the car-body-acceleration curve of Amin continuously] of a between. That is, the relative acceleration difference of a logical car-body-acceleration curve and a physical car-body-acceleration curve measures the duration time [it exceeded the default alpha] of a between. A provisional failure detection flag is set during a count of the duration time [the acceleration difference of an upper diagnosis pair exceeded the default alpha at the fail counter] of a between. This provisional failure detection flag shows that the acceleration difference of an upper diagnosis pair exceeded the default alpha, and shows that the acceleration difference of an upper diagnosis pair which output adherence failure may have generated arose to the car-body-acceleration sensor 1. Therefore, when this provisional failure detection flag is formed, the judgment that a car-body-acceleration sensor is still output adherence failure is not carried out.

[0057]And when the duration time in which the acceleration difference of an upper diagnosis pair exceeded the default alpha is below between existing scheduled time, a provisional failure detection flag is reset. Here, during existing scheduled time, as long as the car-body-acceleration sensor 1 is functioning normally as mentioned above, it is a value which is set as the time when the relative acceleration difference of a logical car-body-acceleration curve and a physical car-body-acceleration curve is longer than the time continuously exceeding the default alpha, and is calculated by experiment etc. That is, as numerals F1 showed, in below for [whose duration time in which the acceleration difference of an upper diagnosis pair exceeded the default alpha is during existing scheduled time] 1 second. For example, with the level difference of a road surface, etc., momentarily strong car body acceleration judges with what is depended on having acted on the body, resets a provisional failure detection flag, and continues the detection processing of output adherence failure.

[0058]When the duration time in which the acceleration difference of an upper diagnosis pair exceeded the default alpha on the other hand exceeds between existing scheduled time, the difference of the maximum of the physical car body acceleration [the acceleration difference of an upper diagnosis pair exceeded the default alpha] of a between and the minimum is calculated and computed, and it compares with the default beta. Here, the default beta is a value which is set as the maximum of the acceleration range of fluctuation which the car-body-acceleration sensor 1 may output in the state where the car-body-acceleration sensor 1 is carrying out output adherence failure, and is calculated by experiment etc. That is, when as the numerals F2 showed, while [1 second] the duration time in which the acceleration difference of an upper diagnosis pair exceeded the default alpha is during existing scheduled time pass, it is judged whether the acceleration difference beyond the default alpha of an upper diagnosis pair is what is depended on output adherence failure of the car-body-acceleration sensor 1. In the embodiment concerned, the default beta is set as about 0.98 m/S^2.

[0059]In the range without fear of the erroneous detection of output adherence failure, the shorter possible one is preferred during existing scheduled time, and detection of output adherence failure is attained in shorter time. In the range without fear of the erroneous detection of output adherence failure, the smaller possible one of the default beta is preferred, and detection of output adherence failure is attained in high accuracy. In the embodiment concerned, it is set as about 1 second during existing scheduled time.

[0060]And when the difference of the maximum of the above-mentioned physical car body acceleration and

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the minimum is below the default beta, it judges with it being the output adherence failure which adhered with the output of the car-body-acceleration sensor 1 not changed, and while resetting a provisional failure detection flag, a failure detection flag is formed. When it judges with output adherence failure and a failure flag is formed, while making the alarm lamp 5 in the car turn on, an ABS control function is stopped and operation of a brake is usually enabled. The failure code of output adherence failure of the car-body-acceleration sensor 1 is memorized to the nonvolatile storage medium which is not illustrated.

[0061]On the other hand, like the dashed line shown with the numerals C, when the difference of the maximum of the above-mentioned physical car body acceleration and the minimum is over the default beta, For example, when going up the slope which has a big angle of inclination or going down, with gravity, it judges with it being what is depended on change of the car body acceleration which acts on the body, and a failure detection flag is not formed. A provisional failure detection flag is reset and the detection processing of output adherence failure is stopped.

[0062]Drawing 3 is the flow chart which showed the output adherence failure detection procedure of the car-body-acceleration sensor 1 concerning the invention in this application. First, it is judged whether ABS control by ABS is performed to the brake system (Step S1). If it is during ABS control (it is No at Step S1), output adherence failure detection of the car-body-acceleration sensor 1 will not be performed. On the other hand, if it is not during ABS control (it is Yes at Step S1), it will continue and it will be judged above speed with constant vehicles whether it is [be / it] under run (Step S2). If it is not under run above speed with constant vehicles, i.e., it is under stop (it is No at Step S2), output adherence failure detection of the car-body-acceleration sensor 1 will not be performed. On the other hand, if it is under run above speed with constant vehicles (it is Yes at Step S2), output adherence failure detection of the car-body-acceleration sensor 1 will be performed.

[0063]It continues, the relative difference of the logical car body acceleration calculated from wheel speed and the physical car body acceleration which the car-body-acceleration sensor 1 outputs is searched for, and it compares with said default alpha (Step S3). The absolute value of the difference of logical car body acceleration and physical car body acceleration at the (step S3 at the time of below the default alpha No), When it considers that the car-body-acceleration sensor 1 is normal and the default alpha is exceeded, at the (step S3, at Yes) and its time, the provisional failure detection flag mentioned above is formed, and count-up of a fail counter is started (step S4). It memorizes always updating the minimum and the maximum of physical car body acceleration from the time of count-up of a fail counter being started. and the value of the fail counter [the absolute value of the difference of logical car body acceleration and physical car body acceleration is over the default alpha] of a between -- the time of 1 or less second -- (-- step S4 -- No), as mentioned above, Momentarily strong car body acceleration judges with what is depended on having acted on the body, and resets a provisional failure detection flag.

[0064]On the other hand, the value of the fail counter [the absolute value of the difference of logical car body acceleration and physical car body acceleration is over the default alpha] of a between, When 1 second is exceeded, by (step S4, the maximum in the meantime and minimum of physical car body acceleration which were Yes(ed)) continued and memorized are acquired (Step S5), and the difference is calculated and computed, and it compares with said default beta (Step S6). the difference of the maximum and minimum -- the time more than the default beta -- (-- Step S6 -- No), as mentioned above, For example, when going up

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the slope which has a big angle of inclination or going down, with gravity, it judges with it being what is depended on change of the car body acceleration which acts on the body, and the output adherence failure detection flag of the car-body-acceleration sensor 1 is not formed. A provisional failure detection flag is reset and output adherence failure detection processing is stopped (Step S7).

[0065]And while the difference of the maximum and minimum judges with it being the output adherence failure which adhered not changing the output of Yes) and the car-body-acceleration sensor 1 at the (step S6 at the time of less than the default beta and resets a provisional failure detection flag, an output adherence failure detection flag is formed (Step S8).

[0066]Thus, when going up the slope which has a big angle of inclination or going down, It becomes possible to detect output adherence failure of a car-body-acceleration sensor exactly also in the situation where the car body acceleration which acts on the body is small, without detecting output adherence failure accidentally, although a car-body-acceleration sensor is normal.

[0067]As other embodiments, in the above-mentioned 1 embodiment, it changes to comparing the relative acceleration difference of car body acceleration, and what compares the relative difference of the variation of car body acceleration is mentioned. Thus, also by comparing the relative difference of the variation of logical car body acceleration, and the variation of physical car body acceleration, operation of the invention in this application is possible, and the same operation effect as the above-mentioned 1 embodiment is obtained. Since influence of a gap of the relative acceleration difference of logical car body acceleration and physical car body acceleration is not received by measuring the variation of car body acceleration, detection of output adherence failure of a car-body-acceleration sensor is attained in higher accuracy.

[0068]Various modification is possible for the invention in this application within the limits of the invention indicated to Claims without being limited to above-mentioned working example, and it cannot be overemphasized that they are also what is contained within the limits of the invention in this application.

[0069]

[Effect of the Invention]When according to the invention in this application going up the slope which has a big angle of inclination or going down, Also in the situation where the car body acceleration which acts on the body is small, detection of output adherence failure of a car-body-acceleration sensor is attained exactly, without detecting output adherence failure accidentally, although a car-body-acceleration sensor is normal.

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TECHNICAL FIELD

[Field of the Invention]The invention in this application relates to the output adherence failure detection programs of the output adherence failure detection method of the car-body-acceleration sensor carried in the car which has an anti-lock brake system for vehicles, the output adherence fault detection device of a car-body-acceleration sensor, and a car-body-acceleration sensor.

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PRIOR ART

[Description of the Prior Art]A wheel decelerating signal required for control of an anti-lock brake system (hereafter referred to as ABS) can be easily obtained by two-wheel-drive car with a non driving wheel. However, since all the wheels are connected with the large engine of moment of inertia when a center differential and a rear wheel shaft differential are locked and four wheels set in the direct connection state in a four-wheelp-drive car, The speed of response of the wheel to change of braking torque falls remarkably. For this reason, it will almost be impossible to acquire a wheel decelerating signal, and a wheel will be locked by it.

[0003]Generally as one of the means for solving such a problem, the car-body-acceleration sensor is carried in the four-wheelp-drive car. By this car-body-acceleration sensor, the car body acceleration of the direction of movement of the body is measured, and if the deceleration at the time of brake braking is smaller than constant value, it will judge with it being a road surface with the low frictional resistance value mu (henceforth a low mu road side). and a road surface with the high frictional resistance value mu (henceforth a high mu road surface) -- the lock of the wheel is prevented by switching to the slip control logic for low mu road sides from the slip control logic of business, and raising control precision.

[0004]Therefore, this car-body-acceleration sensor is indispensable in ABS of a four-wheelp-drive car. When a car-body-acceleration sensor breaks down, slip control becomes impossible and a possibility that a wheel may lock arises.

Therefore, it can be said that the failure detection of a car-body-acceleration sensor is indispensable. The failure mode of a car-body-acceleration sensor has the output adherence failure from which the acceleration of the body will be followed, outputting a fixed car-body-acceleration signal as one of them, and a car-body-acceleration output signal will not change, although some failure modes are assumed.

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EFFECT OF THE INVENTION

[Effect of the Invention]When according to the invention in this application going up the slope which has a big angle of inclination or going down, Also in the situation where the car body acceleration which acts on the body is small, detection of output adherence failure of a car-body-acceleration sensor is attained exactly, without detecting output adherence failure accidentally, although a car-body-acceleration sensor is normal.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]As the 1st conventional technology that detects output adherence failure of this car-body-acceleration sensor, the art currently indicated by JP,H1-195168,A is publicly known. At the time of ABS un-controlling, this measures the car body acceleration calculated from the output of the wheel speed sensor, and the car body acceleration which the car-body-acceleration sensor detected, and when the difference is beyond a predetermined value, it judges with a car-body-acceleration sensor being output adherence failure.

[0006]However, although a car-body-acceleration sensor is normal when going up the slope which has a big angle of inclination, for example or going down, a big difference may arise between the car body acceleration calculated from the output of the wheel speed sensor, and the car body acceleration which the car-body-acceleration sensor detected. Therefore, there is a possibility that it may detect output adherence failure accidentally.

[0007]The art currently indicated by JP,H8-184610,A is publicly known as the 2nd conventional technology that canceled the fault of the 1st conventional technology shown above. This sets as a threshold the car body acceleration which acts on the body with the gravity assumed when going up the slope which has a sufficiently big angle of inclination or going down, When the car body acceleration calculated from the output of the wheel speed sensor is larger than this threshold and the car body acceleration which the car-body-acceleration sensor detected is smaller than this threshold, it judges with a car-body-acceleration sensor being output adherence failure. It is defined as other conditions at the time of judging with output adherence failure that it is at the ABS time of not controlling, that the body is running, and that the wheel speed difference of two or more wheels is below the predetermined speed difference.

[0008]Thus, by setting the car body acceleration which acts on the body with the gravity at the time of the 2nd conventional technology shown above going up the slope which has a sufficiently big angle of inclination, or going down as a threshold, When going up the slope which has a big angle of inclination or going down, although a car-body-acceleration sensor is normal, it prevents detecting output adherence failure accidentally.

[0009]However, unless the car body acceleration equivalent to it acts on the body when the 2nd conventional technology shown above goes up the slope which has a sufficiently big angle of inclination or it goes down or, output adherence failure of a car-body-acceleration sensor can be detected. Therefore, for example, since the car body acceleration which acts on the body is small at the time of a flat low mu road side run, even if output

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adherence failure of a car-body-acceleration sensor occurs, it cannot detect, but there is a possibility that ABS for vehicles may not operate normally by it.

[0010]In view of such a situation, accomplish the invention in this application, and the SUBJECT, Without detecting output adherence failure accidentally, although a car-body-acceleration sensor is normal when going up the slope which has a big angle of inclination or going down, And it is that the car body acceleration which acts on the body enables detection of output adherence failure of a car-body-acceleration sensor exactly also in a small situation.

[Translation done.]

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MEANS

[Means for Solving the Problem]In order to attain an aforementioned problem, an invention of a description to claim in this application 1, Logical car body acceleration which is an output adherence failure detection method of a car-body-acceleration sensor carried in a car which has ABS for vehicles, and was calculated from wheel speed, A relative acceleration difference with physical car body acceleration which said car-body-acceleration sensor detected is calculated, Measure duration time in the state where this acceleration difference exceeded the default alpha, and while this acceleration difference is in a state beyond the default alpha, the minimum acceleration and maximum acceleration of said physical car body acceleration are memorized, When duration time in the state where said acceleration difference exceeded said default alpha exceeds between existing scheduled time, When a difference of said memorized minimum acceleration and said maximum acceleration is below the default beta, it is an output adherence failure detection method of a car-body-acceleration sensor characterized by what is judged as said car-body-acceleration sensor being an output adherence failed state.

[0012]First, since a relative acceleration difference of logical car body acceleration calculated from wheel speed and physical car body acceleration which a car-body-acceleration sensor detected is compared, even if car body acceleration which acts on the body is small, it becomes possible to detect output adherence failure of a car-body-acceleration sensor. And when duration time in the state where the acceleration difference exceeded the default alpha is measured and the duration time exceeds between existing scheduled time, Since it judges with a car-body-acceleration sensor being an output adherence failed state, there are few possibilities of detecting output adherence failure accidentally with a level difference of a road surface, etc. even if momentarily strong car body acceleration acts on the body.

[0013]Here, as long as a car-body-acceleration sensor is functioning normally, the default alpha is set as the maximum of a relative acceleration difference of a logical car-body-acceleration curve and a physical car-body-acceleration curve which may be produced continuously, and is calculated by experiment etc. In a range without fear of erroneous detection of output adherence failure, the smaller possible one of this default alpha is preferred, and detection of output adherence failure is attained by high sensitivity. As long as a car-body-acceleration sensor is functioning normally, it is set as time when a relative acceleration difference of a logical car-body-acceleration curve and a physical car-body-acceleration curve is longer than time continuously exceeding the default alpha during existing scheduled time, and it is called for by experiment etc. In a range without fear of erroneous detection of output adherence failure, the shorter possible one is preferred during

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this existing scheduled time, and detection of output adherence failure is attained in shorter time.

[0014]While said acceleration difference is in a state beyond the default alpha, the minimum acceleration and maximum acceleration of physical car body acceleration are memorized. And when duration time in the state where said acceleration difference exceeded the default alpha exceeds between existing scheduled time, only when a difference of the minimum acceleration of car body acceleration and maximum acceleration which were memorized is below the default beta, it judges with a car-body-acceleration sensor being an output adherence failed state. The default beta is set as the maximum of the acceleration range of fluctuation which a car-body-acceleration sensor outputs in the state where a car-body-acceleration sensor is carrying out output adherence failure, and is calculated by experiment etc. here. In a range without fear of erroneous detection of output adherence failure, the smaller possible one of this default beta is preferred, and detection of output adherence failure is attained in high accuracy.

[0015]When said acceleration difference continues during existing scheduled time, and exceeds the default alpha by this, and said the acceleration difference goes up a slope which has a big angle of inclination or it goes down, it can be judged whether it produces by change of car body acceleration which acts on the body with gravity. That is, if a car-body-acceleration sensor is carrying out output adherence failure, car body acceleration which a car-body-acceleration sensor outputs should not be changed, When a car-body-acceleration sensor goes up a slope which has a big angle of inclination in the normal state or it goes down, car body acceleration which a car-body-acceleration sensor outputs can be judged by changing sharply.

[0016]According to the output adherence failure detection method of a car-body-acceleration sensor concerning an invention given in claim in this application 1, by this. Without detecting output adherence failure accidentally, although a car-body-acceleration sensor is normal when going up a slope which has a big angle of inclination or going down, And a operation effect of becoming possible to detect output adherence failure of a car-body-acceleration sensor exactly also in a situation where car body acceleration which acts on the body is small is obtained.

[0017]Variation per unit time of logical car body acceleration which an invention given in claim in this application 2 is an output adherence failure detection method of a car-body-acceleration sensor carried in a car which has ABS for vehicles, and was calculated from wheel speed, A relative variation difference with variation per unit time of physical car body acceleration which said car-body-acceleration sensor detected is calculated, Measure duration time in the state where this variation difference exceeded the default alpha, and while this variation difference is in a state beyond the default alpha, the maximum of variation per unit time of said physical car body acceleration is memorized, When duration time in the state where said variation difference exceeded said default alpha exceeds between existing scheduled time and the maximum of said memorized variation is below the default beta, it is an output adherence failure detection method of a car-body-acceleration sensor characterized by what is judged as said car-body-acceleration sensor being an output adherence failed state.

[0018]Thus, since a relative variation difference of variation per unit time of logical car body acceleration calculated from wheel speed and variation per unit time of physical car body acceleration which a car-body-acceleration sensor detected is compared, Even if car body acceleration which acts on the body is small, it becomes possible to detect output adherence failure of a car-body-acceleration sensor. And when duration time in the state where said variation difference exceeded the default alpha is measured and the duration time

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exceeds between existing scheduled time, Since it judges with a car-body-acceleration sensor being an output adherence failed state, there are few possibilities of detecting output adherence failure accidentally with a level difference of a road surface, etc. even if it changes variation per unit time of car body acceleration momentarily.

[0019]Here, as long as a car-body-acceleration sensor is functioning normally, the default alpha is set as a bigger value than the maximum of said variation difference which may be produced continuously, and is calculated by experiment etc. In a range without fear of erroneous detection of output adherence failure, the smaller possible one of this default alpha is preferred, and detection of output adherence failure is attained by high sensitivity. As long as a car-body-acceleration sensor is functioning normally, it is set as time when said variation difference is longer than time continuously exceeding the default alpha during existing scheduled time, and it is called for by experiment etc. In a range without fear of erroneous detection of output adherence failure, the shorter possible one is preferred during this existing scheduled time, and detection of output adherence failure is attained in shorter time.

[0020]While said variation difference is in a state beyond the default alpha, the maximum of variation per unit time of physical car body acceleration is memorized. And when duration time in the state where said variation difference exceeded the default alpha exceeds between existing scheduled time, only when the maximum of variation per unit time of memorized car body acceleration is below the default beta, it judges with a car-body-acceleration sensor being an output adherence failed state. The default beta is set as the maximum of the acceleration range of fluctuation in which a car-body-acceleration sensor carries out a car-body-acceleration sensor output in the state where output adherence failure is carried out, and is calculated by experiment etc. here. In a range without fear of erroneous detection of output adherence failure, the smaller possible one of this default beta is preferred, and detection of output adherence failure is attained in high accuracy.

[0021]When said variation difference continues during existing scheduled time, and exceeds the default alpha by this, and said the variation difference goes up a slope which has a big angle of inclination or it goes down, it can be judged whether it is what is depended on change of car body acceleration which acts on the body with gravity. That is, if a car-body-acceleration sensor is carrying out output adherence failure, car body acceleration which a car-body-acceleration sensor outputs should not be changed, When a car-body-acceleration sensor goes up a slope which has a big angle of inclination in the normal state or it goes down, car body acceleration which a car-body-acceleration sensor outputs can be judged by changing sharply.

[0022]Since a relative variation difference of variation per unit time of logical car body acceleration calculated from wheel speed and variation per unit time of physical car body acceleration which a car-body-acceleration sensor detected is compared, Since influence of a gap of a relative acceleration difference of logical car body acceleration and physical car body acceleration is not received, detection of output adherence failure of a car-body-acceleration sensor is attained in still higher accuracy rather than comparing a relative acceleration difference of car body acceleration.

[0023]According to the output adherence failure detection method of a car-body-acceleration sensor concerning an invention given in claim in this application 2, by this. When going up a slope which has a big angle of inclination to claim in this application 1 like an invention of a description or going down, A operation effect of becoming possible to detect output adherence failure of a car-body-acceleration sensor exactly also in a situation where car body acceleration which acts on the body is small is obtained without detecting output

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adherence failure accidentally, although a car-body-acceleration sensor is normal. Since influence of a gap of a relative acceleration difference of logical car body acceleration and physical car body acceleration is not received in addition to the above-mentioned operation effect, detection of output adherence failure of a car-body-acceleration sensor is attained in still higher accuracy rather than comparing a relative acceleration difference of car body acceleration.

[0024]An invention given in claim in this application 3 is an output adherence failure detection method of a car-body-acceleration sensor characterized by what output adherence failure detection of said car-body-acceleration sensor is performed for the time of ABS un-controlling, and only while said car is running above a predetermined speed in Claim 1 or 2.

[0025]Since a big difference may arise between body speed and wheel speed at the time of ABS control, a possibility that it may detect output adherence failure of a car-body-acceleration sensor accidentally arises. Therefore, it becomes possible by performing output adherence failure detection of a car-body-acceleration sensor at the time of ABS un-controlling to lessen a possibility of detecting output adherence failure of a car-body-acceleration sensor accidentally.

[0026]Although wheel speed under stop is 0 and car body acceleration is also 0, an output of a car-body-acceleration sensor may be changed by factors, such as people's getting on and off, taking up and down of a cargo, or a stop at a slope. Therefore, a possibility that it may detect output adherence failure of a car-body-acceleration sensor accidentally arises. Therefore, when it is not [jam / which is under run above a predetermined speed] under stop, it becomes possible by performing output adherence failure detection of a car-body-acceleration sensor to lessen a possibility of detecting output adherence failure of a car-body-acceleration sensor accidentally.

[0027]According to the output adherence failure detection method of a car-body-acceleration sensor concerning an invention given in claim in this application 3, by this. 2 to claim in this application 1 or a operation effect by invention of a description in addition, by performing output adherence failure detection of a car-body-acceleration sensor, the time of ABS un-controlling, and only while a car is running above a predetermined speed, A operation effect of becoming possible to lessen a possibility of detecting output adherence failure of a car-body-acceleration sensor accidentally is obtained.

[0028]When it judges with said car-body-acceleration sensor being an output adherence failed state in any 1 paragraph of Claims 1-3, an invention given in claim in this application 4, While making a fault lamp turn on and telling a driver about failure, it is an output adherence failure detection method of a car-body-acceleration sensor characterized by what a failure code is memorized for to a nonvolatile storage medium.

[0029]Thus, when [whose a car-body-acceleration sensor is output adherence failure] it judges, Since it tells that made a fault lamp provided in in the car turn on, a certain failure occurred in ABS to a driver, and an ABS control function has stopped, it enables him for a driver to recognize it and to take suitable action. Simultaneously, since a failure code is memorized to a nonvolatile storage medium, it becomes possible by referring to a failure code to get to know that a factor which a fault lamp turned on is output adherence failure of a car-body-acceleration sensor.

[0030]According to the output adherence failure detection method of a car-body-acceleration sensor concerning an invention given in claim in this application 4, by this. While being able to urge a driver's suitable action by transmitting failure of ABS to a driver at the time of output adherence failure of a car-body-

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acceleration sensor in addition to a operation effect by invention given in any 1 paragraph of claim in this application 1-3, Flume ********** which can recognize that trouble indication of ABS is output adherence failure of a car-body-acceleration sensor is obtained.

[0031]A wheel speed sensor which an invention given in claim in this application 5 is an output adherence fault detection device of a car-body-acceleration sensor carried in a car which has ABS for vehicles, and outputs an AC signal of frequency proportional to revolving speed of a wheel, A control section which has a calculation function which inputs an AC signal from a wheel speed sensor, calculates wheel speed, and computes car body acceleration logically from this wheel speed, Detect car body acceleration physically, have a car-body-acceleration sensor outputted to said control section, and said control section, A means to calculate a relative acceleration difference of logical car body acceleration calculated from said wheel speed, and physical car body acceleration which said car-body-acceleration sensor detected, A means to measure duration time in the state where this acceleration difference exceeded the default alpha, and a means to memorize the minimum acceleration and maximum acceleration of said physical car body acceleration while this acceleration difference is in a state beyond the default alpha, When duration time in the state where said acceleration difference exceeded said default alpha exceeds between existing scheduled time, When a difference of said memorized minimum acceleration and said maximum acceleration is below the default beta, it is an output adherence fault detection device of a car-body-acceleration sensor characterized by what it has a means to judge with said car-body-acceleration sensor being an output adherence failed state for. According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 5, the same operation effect as an invention of a description can be obtained to claim in this application 1 mentioned above.

[0032]A wheel speed sensor which an invention given in claim in this application 6 is an output adherence fault detection device of a car-body-acceleration sensor carried in a car which has ABS for vehicles, and outputs an AC signal of frequency proportional to revolving speed of a wheel, A control section which has a calculation function which inputs an AC signal from a wheel speed sensor, calculates wheel speed, and computes car body acceleration logically from this wheel speed, Detect car body acceleration physically, have a car-body-acceleration sensor outputted to said control section, and said control section, Variation per unit time of logical car body acceleration calculated from said wheel speed, A means to calculate a relative variation difference with variation per unit time of physical car body acceleration which said car-body-acceleration sensor detected, A means to measure duration time in the state where this variation difference exceeded the default alpha, and a means to memorize the maximum of variation per unit time of said physical car body acceleration while being in a state in which this variation difference exceeded the default alpha, When duration time in the state where said variation difference exceeded said default alpha exceeds between existing scheduled time, When the maximum of said memorized variation is below the default beta, it is an output adherence fault detection device of a car-body-acceleration sensor characterized by what it has a means to judge with said car-body-acceleration sensor being an output adherence failed state for. According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 6, the same operation effect as an invention of a description can be obtained to claim in this application 2 mentioned above.

[0033]In Claim 5 or 6, an invention of a description to claim in this application 7 said control section, The time

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of ABS un-controlling, and only while said car is running above a predetermined speed, it is an output adherence fault detection device of a car-body-acceleration sensor characterized by what it has a means to perform output adherence failure detection of said car-body-acceleration sensor for. According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 7, the same operation effect as an invention of a description can be obtained to claim in this application 3 mentioned above.

[0034]In any 1 paragraph of Claims 5-7, an invention of a description to claim in this application 8 said control section, When it judges with said car-body-acceleration sensor being an output adherence failed state, it is an output adherence fault detection device of a car-body-acceleration sensor characterized by what it has a means to make a fault lamp for telling a driver about failure turn on, and a means to memorize a failure code to a nonvolatile storage medium for. According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 8, the same operation effect as an invention of a description can be obtained to claim in this application 4 mentioned above.

[0035]An invention given in claim in this application 9 is an output adherence fault detection device of a car-body-acceleration sensor characterized by what said car-body-acceleration sensor is an analog type G sensor in any 1 paragraph of Claims 5-8.

[0036]An analog type G sensor comprises an electronic circuit using a Hall device, detects acceleration of a cross direction which acts on the body at a fine step, and an output is possible for it. Since it comprises an electronic circuit, when one of the electronic devices breaks and an output of a car-body-acceleration signal adheres, for example by a certain factor, there is no telling with which value a value of car body acceleration adheres. An output signal which adhered may be changed to some extent.

[0037]According to the output adherence fault detection device of a car-body-acceleration sensor concerning an invention given in claim in this application 9. It becomes possible to detect output adherence failure in high accuracy by a operation effect by invention of a description in a car-body-acceleration sensor using an analog type G sensor mentioned above in any 1 paragraph of claim in this application 5-8.

[0038]An invention given in claim in this application 10 is ABS for vehicles which equipped any 1 paragraph of Claims 5-9 with an output adherence fault detection device of a car-body-acceleration sensor of a description. According to ABS for vehicles concerning an invention given in claim in this application 10, in ABS for vehicles, a operation effect by invention given in any 1 paragraph of claim in this application 5-9 mentioned above can be obtained.

[0039]Inventions given in claim in this application 11 are output adherence failure detection programs of a car-body-acceleration sensor which make a computer perform output adherence failure detection of a car-body-acceleration sensor carried in a car which has ABS for vehicles, A procedure of calculating a relative acceleration difference of logical car body acceleration calculated from wheel speed, and physical car body acceleration which said car-body-acceleration sensor detected, A procedure which measures duration time in the state where this acceleration difference exceeded the default alpha, and a procedure of memorizing the minimum acceleration and maximum acceleration of said physical car body acceleration while this acceleration difference is in a state beyond the default alpha, When duration time in the state where said acceleration difference exceeded said default alpha exceeds between existing scheduled time, When a difference of said memorized minimum acceleration and said maximum acceleration is below the default beta,

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they are output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has for a procedure judged as said car-body-acceleration sensor being an output adherence failed state.

[0040]While being able to obtain the same operation effect as an invention of a description to claim in this application 1 mentioned above according to the output adherence failure detection programs of a car-body-acceleration sensor concerning an invention given in claim in this application 11, The same operation effect as an invention of a description can be brought to claim in this application 1 mentioned above in arbitrary cars which have ABS for vehicles which can execute output adherence failure detection programs of this car-body-acceleration sensor.

[0041]Inventions given in claim in this application 12 are output adherence failure detection programs of a car-body-acceleration sensor which make a computer perform output adherence failure detection of a car-body-acceleration sensor carried in a car which has ABS for vehicles, Variation per unit time of logical car body acceleration calculated from said wheel speed, A procedure of calculating a relative variation difference with variation per unit time of physical car body acceleration which said car-body-acceleration sensor detected, A procedure which measures duration time in the state where this variation difference exceeded the default alpha, and a procedure of memorizing the maximum of variation per unit time of said physical car body acceleration while being in a state in which this variation difference exceeded the default alpha, When duration time in the state where said variation difference exceeded said default alpha exceeds between existing scheduled time, When the maximum of said memorized variation is below the default beta, they are output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has for a procedure judged as said car-body-acceleration sensor being an output adherence failed state.

[0042]While being able to obtain the same operation effect as an invention of a description to claim in this application 2 mentioned above according to the output adherence failure detection programs of a car-body-acceleration sensor concerning an invention given in claim in this application 12, The same operation effect as an invention of a description can be brought to claim in this application 2 mentioned above in arbitrary cars which have ABS for vehicles which can execute output adherence failure detection programs of this car-body-acceleration sensor.

[0043]In Claim 11 or 12, an invention of a description to claim in this application 13 At the time of ABS un-controlling. And only while said car is running above a predetermined speed, they are output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has the procedure of performing output adherence failure detection of said car-body-acceleration sensor for.

[0044]While being able to obtain the same operation effect as an invention of a description to claim in this application 3 mentioned above according to the output adherence failure detection programs of a car-body-acceleration sensor concerning an invention given in claim in this application 13, The same operation effect as an invention of a description can be brought to claim in this application 3 mentioned above in arbitrary cars which have ABS for vehicles which can execute output adherence failure detection programs of this car-body-acceleration sensor.

[0045]In any 1 paragraph of Claims 11-13 an invention of a description to claim in this application 14, When it judges with said car-body-acceleration sensor being an output adherence failed state, they are output adherence failure detection programs of a car-body-acceleration sensor characterized by what it has a

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procedure of making a fault lamp for telling a driver about failure turning on, and the procedure of memorizing a failure code to a nonvolatile storage medium for.

[0046]While being able to obtain the same operation effect as an invention of a description to claim in this application 4 mentioned above according to the output adherence failure detection programs of a car-body-acceleration sensor concerning an invention given in claim in this application 14, The same operation effect as an invention of a description can be brought to claim in this application 4 mentioned above in arbitrary cars which have ABS for vehicles which can execute output adherence failure detection programs of this car-body-acceleration sensor.

[0047]

[Embodiment of the Invention]Hereafter, the 1 embodiment of the invention in this application is described based on Drawings. Drawing 1 is a block diagram of an outline showing the system configuration of ABS for vehicles concerning the invention in this application provided with the car-body-acceleration sensor.

[0048]The basic constitution of ABS for vehicles comprises the wheel speed sensor 4, ECU(electronic control unit) 2 as a "control section" concerning the invention in this application, and the fluid pressure unit 3.

[0049]The wheel speed sensor 4 generates the AC signal of the frequency proportional to the revolving speed of the wheel 41 by detecting the cog in the wheel 42 rotated with the wheel 41.

[0050]ECU2 inputted the AC signal transmitted from the wheel speed sensor 4, it calculated wheel speed, and is provided with the arithmetic block 21 which has a calculation function which computes slip ratio and the degree of wheel acceleration and deceleration based on it. ECU2 inputted the slip ratio and the degree of wheel acceleration and deceleration which the arithmetic block 21 computed, was combined logically, generated the control instruction to brake pressure, and is provided with the control block 22 which has a control facility transmitted to the fluid pressure unit 3. When ECU2 performs the function check and surveillance of each component parts or the whole system and a defect arises in them, After carrying out an alarm to a driver with the alarm lamp 5, the warning buzzer which is not illustrated, etc., while stopping an ABS control function, it has the monitor block 23 which has a system-monitor function which usually enables operation of a brake.

[0051]The fluid pressure unit 3 is allocated between the master cylinder 6 and the wheel cylinder 44, The brake pedal 7 steps on and brake pressure is made to fluctuate directly or indirectly in response to the control instruction from ECU2 by driving the electromagnetic valve 31, a pump, a motor which are not illustrated, etc. apart from the change in brake pressure to the brake disc 43 by power.

[0052]The car-body-acceleration sensor 1 is a sensor which detects the acceleration of a direction of movement. And it judges with being a low mu road side, if the car body acceleration which the car-body-acceleration sensor 1 outputs has the deceleration smaller than constant value which it was inputted into the arithmetic block 21 of ECU2, and the car-body-acceleration sensor 1 detected. And the control block 22 has prevented the lock of the wheel 41 by switching to the slip control logic for low mu road sides from the slip control logic for high mu road surfaces, and raising control precision. The failure surveillance of the car-body-acceleration sensor 1 is carried out at the monitor block 23. In the embodiment concerned, the car-body-acceleration sensor 1 is an analog type G sensor. The analog type G sensor comprises an electronic circuit using a Hall device, detects the acceleration of the cross direction which acts on the body at a fine step, and an output is possible for it. Even if the car-body-acceleration sensor 1 in particular is not limited to an analog

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type G sensor and is the car-body-acceleration sensor 1 by other methods, operation of the invention in this application is possible for it.

[0053]The output adherence failure detection procedure of the car-body-acceleration sensor 1 concerning the invention in this application in ABS which accomplishes such basic constitution is explained hereafter, referring to a timing chart and a flow chart.

[0054]Drawing 2 is the timing chart which showed the timing of the output adherence failure detection of the car-body-acceleration sensor concerning the invention in this application. The curve shown with the numerals A is a logical car-body-acceleration curve which showed the logical car body acceleration calculated from wheel speed. The curve shown with the numerals B is a physical car-body-acceleration curve which showed the physical car body acceleration detected by the car-body-acceleration sensor 1. The curve of the dashed line shown by Amax is a car-body-acceleration curve which added the default alpha to the logical car-body-acceleration curve as a graphic display, and the curve of the dashed line shown by Amin is a car-body-acceleration curve which subtracted the default alpha from the logical car-body-acceleration curve as a graphic display.

[0055]Here, the default alpha is a value which is set as the maximum of the relative acceleration difference of the logical car-body-acceleration curve and physical car-body-acceleration curve which may be produced continuously, and is calculated by experiment etc., as long as the car-body-acceleration sensor 1 is functioning normally as mentioned above. In the range without fear of the erroneous detection of output adherence failure, the smaller possible one of this default alpha is preferred, and detection of output adherence failure is attained by high sensitivity. Therefore, a physical car-body-acceleration curve does not perform output adherence failure detection of a car-body-acceleration sensor, while changing the field between the car-body-acceleration curve of Amax, and the car-body-acceleration curve of Amin. In the embodiment concerned, the default alpha is set as about 1.47 m/S^2. Although not illustrated, the curve of the above-mentioned car body acceleration is a curve which made the vertical axis car body acceleration and to which it set the time-axis as the horizontal axis.

[0056]A fail counter counts the duration time [the physical car-body-acceleration curve is changing the outside of the field between the car-body-acceleration curve of Amax, and the car-body-acceleration curve of Amin continuously] of a between. That is, the relative acceleration difference of a logical car-body-acceleration curve and a physical car-body-acceleration curve measures the duration time [it exceeded the default alpha] of a between. A provisional failure detection flag is set during a count of the duration time [the acceleration difference of an upper diagnosis pair exceeded the default alpha at the fail counter] of a between. This provisional failure detection flag shows that the acceleration difference of an upper diagnosis pair exceeded the default alpha, and shows that the acceleration difference of an upper diagnosis pair which output adherence failure may have generated arose to the car-body-acceleration sensor 1. Therefore, when this provisional failure detection flag is formed, the judgment that a car-body-acceleration sensor is still output adherence failure is not carried out.

[0057]And when the duration time in which the acceleration difference of an upper diagnosis pair exceeded the default alpha is below between existing scheduled time, a provisional failure detection flag is reset. Here, during existing scheduled time, as long as the car-body-acceleration sensor 1 is functioning normally as

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mentioned above, it is a value which is set as the time when the relative acceleration difference of a logical car-body-acceleration curve and a physical car-body-acceleration curve is longer than the time continuously exceeding the default alpha, and is calculated by experiment etc. That is, as numerals F1 showed, in below for [whose duration time in which the acceleration difference of an upper diagnosis pair exceeded the default alpha is during existing scheduled time] 1 second. For example, with the level difference of a road surface, etc., momentarily strong car body acceleration judges with what is depended on having acted on the body, resets a provisional failure detection flag, and continues the detection processing of output adherence failure.

[0058]When the duration time in which the acceleration difference of an upper diagnosis pair exceeded the default alpha on the other hand exceeds between existing scheduled time, the difference of the maximum of the physical car body acceleration [the acceleration difference of an upper diagnosis pair exceeded the default alpha] of a between and the minimum is calculated and computed, and it compares with the default beta. Here, the default beta is a value which is set as the maximum of the acceleration range of fluctuation which the car-body-acceleration sensor 1 may output in the state where the car-body-acceleration sensor 1 is carrying out output adherence failure, and is calculated by experiment etc. That is, when as the numerals F2 showed, while [1 second] the duration time in which the acceleration difference of an upper diagnosis pair exceeded the default alpha is during existing scheduled time pass, it is judged whether the acceleration difference beyond the default alpha of an upper diagnosis pair is what is depended on output adherence failure of the car-body-acceleration sensor 1. In the embodiment concerned, the default beta is set as about 0.98 m/S^2.

[0059]In the range without fear of the erroneous detection of output adherence failure, the shorter possible one is preferred during existing scheduled time, and detection of output adherence failure is attained in shorter time. In the range without fear of the erroneous detection of output adherence failure, the smaller possible one of the default beta is preferred, and detection of output adherence failure is attained in high accuracy. In the embodiment concerned, it is set as about 1 second during existing scheduled time.

[0060]And when the difference of the maximum of the above-mentioned physical car body acceleration and the minimum is below the default beta, it judges with it being the output adherence failure which adhered with the output of the car-body-acceleration sensor 1 not changed, and while resetting a provisional failure detection flag, a failure detection flag is formed. When it judges with output adherence failure and a failure flag is formed, while making the alarm lamp 5 in the car turn on, an ABS control function is stopped and operation of a brake is usually enabled. The failure code of output adherence failure of the car-body-acceleration sensor 1 is memorized to the nonvolatile storage medium which is not illustrated.

[0061]On the other hand, like the dashed line shown with the numerals C, when the difference of the maximum of the above-mentioned physical car body acceleration and the minimum is over the default beta, For example, when going up the slope which has a big angle of inclination or going down, with gravity, it judges with it being what is depended on change of the car body acceleration which acts on the body, and a failure detection flag is not formed. A provisional failure detection flag is reset and the detection processing of output adherence failure is stopped.

[0062]Drawing 3 is the flow chart which showed the output adherence failure detection procedure of the car-body-acceleration sensor 1 concerning the invention in this application. First, it is judged whether ABS control

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by ABS is performed to the brake system (Step S1). If it is during ABS control (it is No at Step S1), output adherence failure detection of the car-body-acceleration sensor 1 will not be performed. On the other hand, if it is not during ABS control (it is Yes at Step S1), it will continue and it will be judged above speed with constant vehicles whether it is [be / it] under run (Step S2). If it is not under run above speed with constant vehicles, i.e., it is under stop (it is No at Step S2), output adherence failure detection of the car-body-acceleration sensor 1 will not be performed. On the other hand, if it is under run above speed with constant vehicles (it is Yes at Step S2), output adherence failure detection of the car-body-acceleration sensor 1 will be performed.

[0063]It continues, the relative difference of the logical car body acceleration calculated from wheel speed and the physical car body acceleration which the car-body-acceleration sensor 1 outputs is searched for, and it compares with said default alpha (Step S3). The absolute value of the difference of logical car body acceleration and physical car body acceleration at the (step S3 at the time of below the default alpha No), When it considers that the car-body-acceleration sensor 1 is normal and the default alpha is exceeded, at the (step S3, at Yes) and its time, the provisional failure detection flag mentioned above is formed, and count-up of a fail counter is started (step S4). It memorizes always updating the minimum and the maximum of physical car body acceleration from the time of count-up of a fail counter being started. and the value of the fail counter [the absolute value of the difference of logical car body acceleration and physical car body acceleration is over the default alpha] of a between -- the time of 1 or less second -- (-- step S4 -- No), as mentioned above, Momentarily strong car body acceleration judges with what is depended on having acted on the body, and resets a provisional failure detection flag.

[0064]On the other hand, the value of the fail counter [the absolute value of the difference of logical car body acceleration and physical car body acceleration is over the default alpha] of a between, When 1 second is exceeded, by (step S4, the maximum in the meantime and minimum of physical car body acceleration which were Yes(ed)) continued and memorized are acquired (Step S5), and the difference is calculated and computed, and it compares with said default beta (Step S6). the difference of the maximum and minimum -- the time more than the default beta -- (-- Step S6 -- No), as mentioned above, For example, when going up the slope which has a big angle of inclination or going down, with gravity, it judges with it being what is depended on change of the car body acceleration which acts on the body, and the output adherence failure detection flag of the car-body-acceleration sensor 1 is not formed. A provisional failure detection flag is reset and output adherence failure detection processing is stopped (Step S7).

[0065]And while the difference of the maximum and minimum judges with it being the output adherence failure which adhered not changing the output of Yes) and the car-body-acceleration sensor 1 at the (step S6 at the time of less than the default beta and resets a provisional failure detection flag, an output adherence failure detection flag is formed (Step S8).

[0066]Thus, when going up the slope which has a big angle of inclination or going down, It becomes possible to detect output adherence failure of a car-body-acceleration sensor exactly also in the situation where the car body acceleration which acts on the body is small, without detecting output adherence failure accidentally, although a car-body-acceleration sensor is normal.

[0067]As other embodiments, in the above-mentioned 1 embodiment, it changes to comparing the relative acceleration difference of car body acceleration, and what compares the relative difference of the variation of

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car body acceleration is mentioned. Thus, also by comparing the relative difference of the variation of logical car body acceleration, and the variation of physical car body acceleration, operation of the invention in this application is possible, and the same operation effect as the above-mentioned 1 embodiment is obtained. Since influence of a gap of the relative acceleration difference of logical car body acceleration and physical car body acceleration is not received by measuring the variation of car body acceleration, detection of output adherence failure of a car-body-acceleration sensor is attained in higher accuracy.

[0068]Various modification is possible for the invention in this application within the limits of the invention indicated to Claims without being limited to above-mentioned working example, and it cannot be overemphasized that they are also what is contained within the limits of the invention in this application.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a block diagram of an outline showing the system configuration of ABS for vehicles concerning the invention in this application provided with the car-body-acceleration sensor.
[Drawing 2]It is the timing chart which showed the timing of the output adherence failure detection of the car-body-acceleration sensor concerning the invention in this application.
[Drawing 3]It is the flow chart which showed the procedure of the output adherence failure detection of the car-body-acceleration sensor concerning the invention in this application.
[Description of Notations]
1 Car-body-acceleration sensor
2 ECU (electronic control unit)
3 Fluid pressure unit
4 Wheel speed sensor
5 Alarm lamp
6 Master cylinder
7 Brake pedal
21 Arithmetic block
22 Control block
23 Monitor block
31 Electromagnetic valve
41 Wheel
42 Gear
43 Brake disc
44 Wheel cylinder

[Translation done.]

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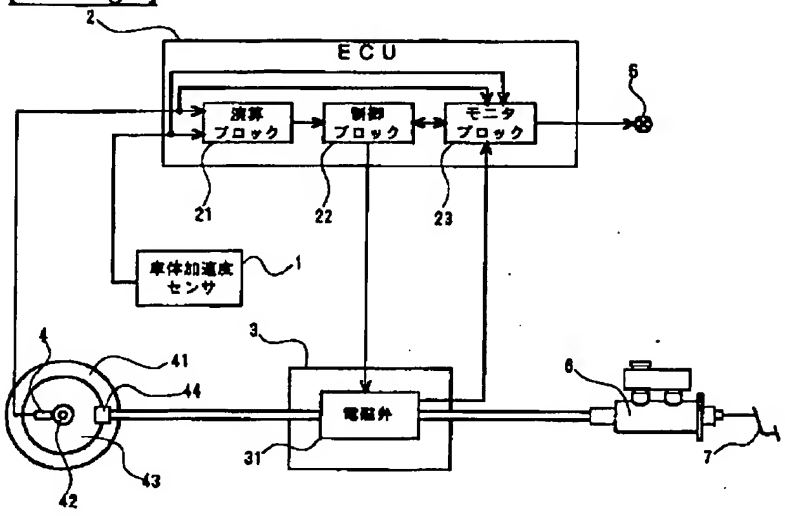
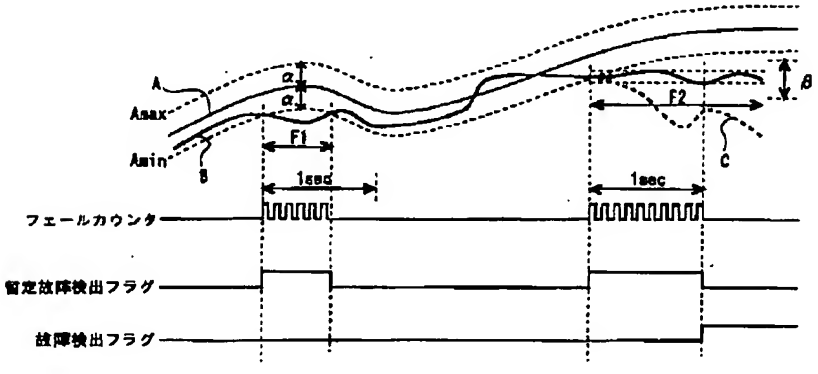
DRAWINGS

[Drawing 1]



[Drawing 2]



[Drawing 3]

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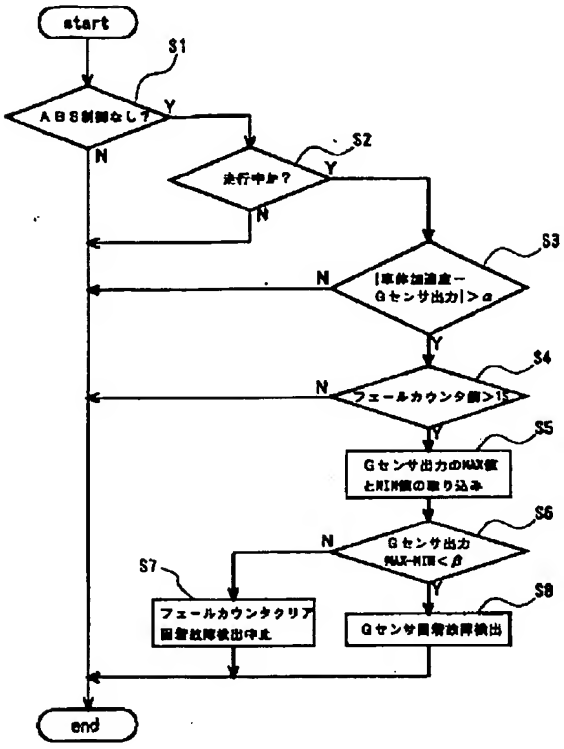

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